The Islamic University of Gaza
Faculty of Engineering
Electrical Engineering department

Electric Circuits for Computer and Industrial Engineering
Principles of electrical engineering ECIV 2321

Second Mid Exam
December 6th , 2010

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Exam Time: 15:00 – 17:00

Name	
ID Number	
Grade	

<u>Read the following:</u>

- You have limited time (2 hours) for this exam.
- There are 4 questions in this exam. you must complete all the questions.
- Stay calm, work steadily, First solve the question you know best. If you get stuck on a problem, move on to attempt the others first.

" اللهم لا سهل إلا ما جعلته سهلا ، وأنت تجعل الحزن إذا شئت سهلا "

الله ولي التوفيق

Question 1

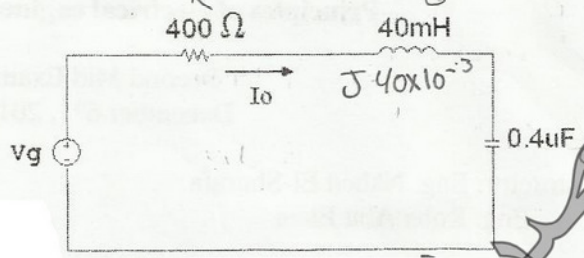
a- From the circuit shown find :

1- Impedance of the circuit Z

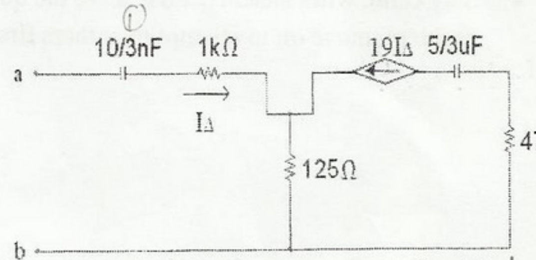
2- Angular frequency w

If $I_o = 100\sin(wt + 81.87)$

$V_g = 50\cos(wt - 45)$ volt



b- For the circuit shown find Zab at w=25krad/sec



$w = 25000$ rad/s

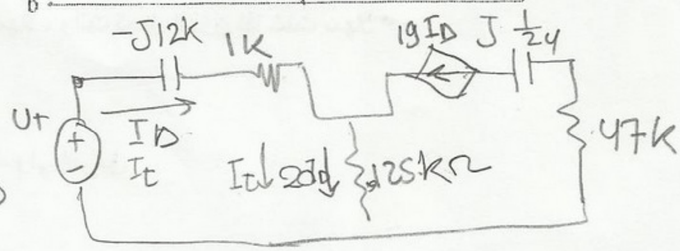
in Fraq. domain $V_{th} = 0$

$10/3\ nf = \frac{1}{J \times \frac{10}{3} \times 10^{-9} \times 25000} = -J12k$

$125\ \Omega = 125\ \Omega$

$5/3uF = JwL = J \times 25000 \times \frac{5}{3} \times 10^{-6}$

$= J\frac{1}{24}$



$V_t = (-J12 + 1)I_D + (.125)20 I_D$

$V_t = I_D(-J12 + 1 + 2.5)$

$\frac{V_t}{I_t} = Z = 3.5 - J12$

Question 2

For the figure shown

VL = 240+J0 volt

Find

a- Vs

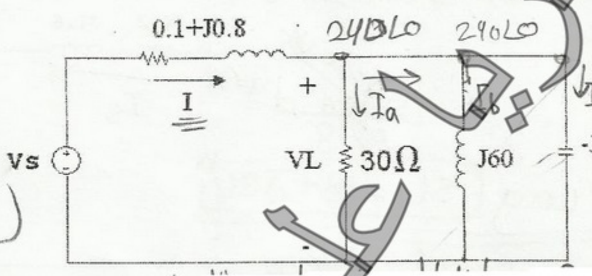
b- Xc

c- Draw the phasor diagram

In the following cases :

I- When Xc makes I minimum

II-When Xc makes |Vs|=|VL|=240 volt



When Xc I minimum — الحالة الأولى

$I_a = \frac{240}{30} = 8A$

$I_b = \frac{240}{60\angle 90} = 4\angle -90 = -J4$

To solve I ... = J4 — $I_{mim} = 8A$

$I_c = J4$

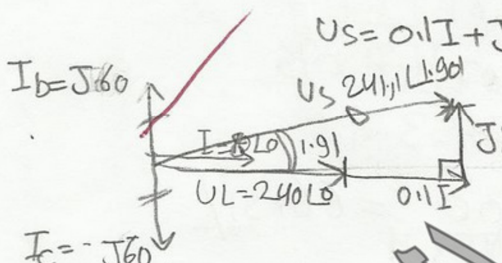
$X_C = \frac{240}{-J4} = -J60$ — $I = 8A$

$V_S = I(0.1 + J0.8) + 240$

$= 10(0.1 + J.8) + 240$

$V_S = 1 + J8 + 240$ — $V_S = 241 + J8$, $241.1\angle 1.901$

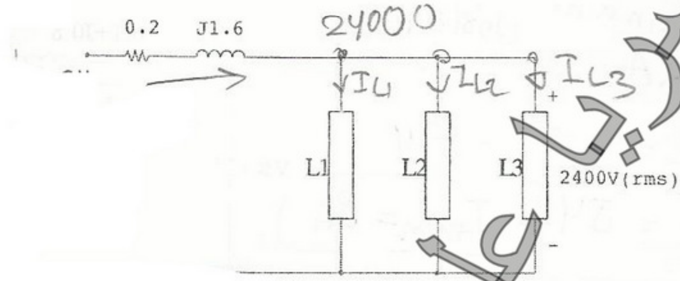
$V_S = 0.1I + J0.8 + 240$



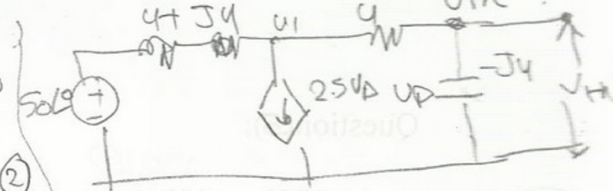
$V_S = 241.1\angle 1.901$

Question 3

For the circuit shown
Load1 absorbs 18kW and 24KVAR
Load2 absorbs 60kVA at 0.6 power factor lead
Load3 absorbs 18kW at unity power factor
Calculate 1) Vs
2) The efficiency of the line = Pload/Psend
3) The impendance of each load



$$① \leftarrow \frac{V_1 - 50\angle 0}{4+j4} + 1.5V_D + \frac{V_1}{4-j4} = 0$$



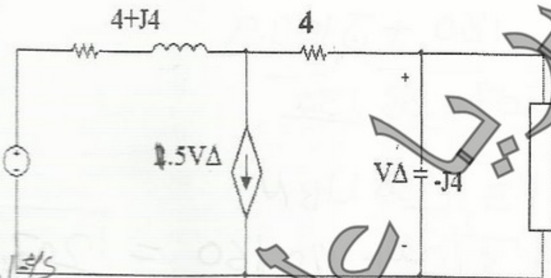
Question 4

For the circuit shown
At maximum power find
a) ZL
b) maximum power
c) Pmax/Psup
In the following Cases :
1- No restriction on the load
2- The load is purely resistive

$$V_D = \frac{V_1 \times -j4}{4-j4} \rightarrow ②$$

$$V_D = V_1 \frac{4\angle -90}{4\sqrt{2}\angle -45} = V_D = 0.707\angle 45\, V_1$$

$$1.5V_D = 1.06\angle -45\, V_1 \rightarrow ③$$



$$\frac{V_1}{4+j4} - \frac{50\angle 0}{4+j4} + 1.06\angle -45\, V_1 + \frac{V_1}{4-j4} = 0$$

$$V_1\left(\frac{1}{4+j4} - 1.06\angle -45 + \frac{1}{4-j4}\right) = \frac{50\angle 0}{4+j4}$$

$$V_1(0.176\angle -45 - 1.06\angle -45 + 0.176\angle 45) = 8.83\angle -45$$

$$V_1(0.124 - j0.124 + 0.749 - j0.749 + 0.124 + j0.124) = 8.83\angle -45$$

$$V_1(0.997 - j0.749) = 8.83\angle -45$$

$$V_1 = \frac{8.83\angle -45}{1.247\angle -36.915} = 7.08\angle -8.085$$

$$V_D = 0.707\angle -45 \times 7.08\angle -8.085 = 5\angle -53.13$$

$$V_D = 3 - j4 = V_{th}$$

$$I_{sc} = \frac{50\angle 0}{8+j4} = 5.6\angle -26.56 = 5 + j2.5$$

$$Z_{th} = \frac{V_{th}}{I_{sc}} = \frac{5\angle -53.13}{5.6\angle 26.56} = 0.89\angle -26.57 = 0.8 - j0.4$$

$$Z_{th} = Z_L^* = 0.8 + j0.4$$

$$I = \frac{5\angle -53.13}{1.6} = 3.125\angle -53.15$$

$$P_{max} = (3.125)^2 \times R = 7.8125\text{ watt}$$

Psup



Question(5):

$120\angle 60$

(a) If $V_{BN} = 120\angle 60$ in a balanced 3 phase Y circuit, find V_{BC} if the sequence is negative.

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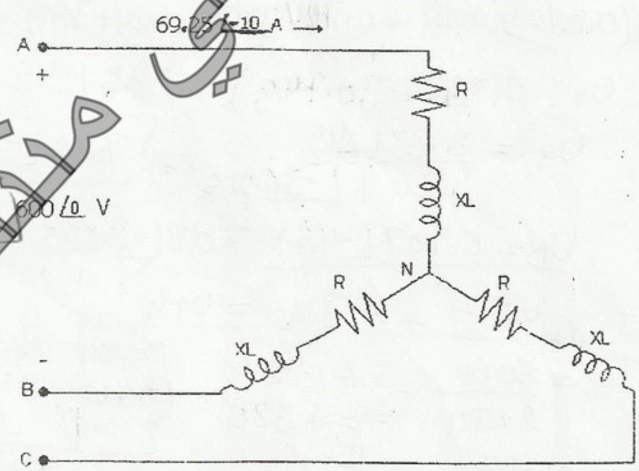
$V_{BC} = V_{BN} - V_{AN}$
$= 120\angle 60 - 120\angle -180$
$= 60 + j103.9 + 120$
$180 + j103.9$

$V_{BC} = 207.83\angle 30$

$V_{BN} = 120\angle 60$
$V_{AN} = 120\angle 0$ $\quad 120\angle -60$
$V_{BN} = 120\angle +120$ $\quad 120\angle 60$
$V_{CN} = 120\angle -120$ $\quad 120\angle -180$

$V_{BC} = \sqrt{3}\angle -30\, V_{BN}$
$\sqrt{3}\angle -30 \cdot 120\angle 60 = 207.83\angle 30$

(b) Find R and X_L, assume negative sequence.



assume negative

$V_{AB} = \sqrt{3}\angle -30 \cdot V_{AN}$

$V_{AN} = \frac{V_{AB}}{\sqrt{3}\angle -30} = \frac{600\angle 0}{\sqrt{3}\angle -30} = 346.41\angle 30$

$Z = \frac{V_{AN}}{I} = \frac{346.41\angle 30}{69.25\angle -10} = 5\angle 40$

$Z = 3.83 + j3.21$

$R = 3.83\ \Omega$
$X_L = j3.21$